# Update on Foreground Subtraction

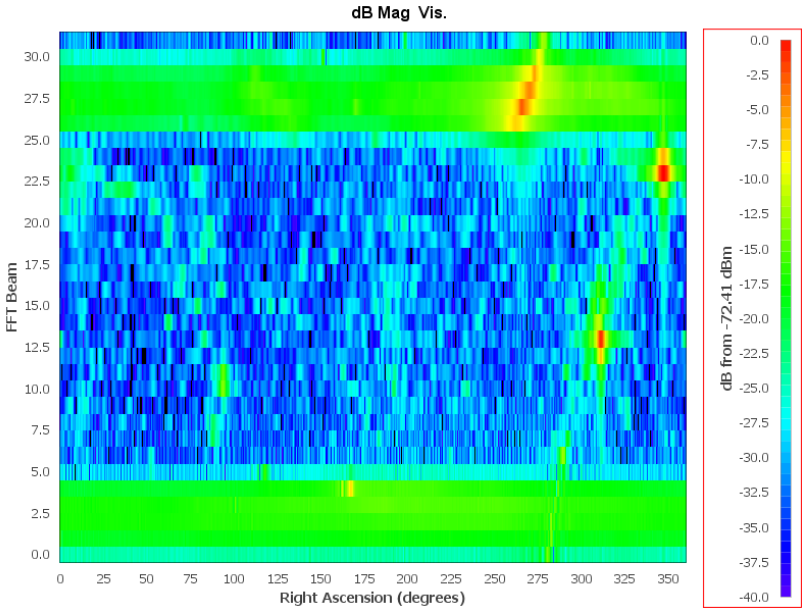
Dave McGinnis

March 2

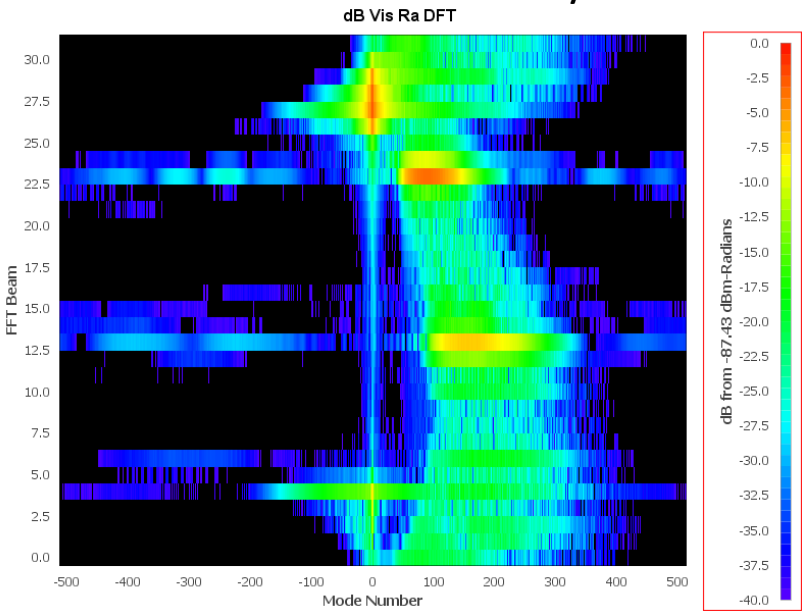
# Pittsburgh Cylinder Simulations

- Simulated Pittsburgh Cylinders (32 feeds at 0.7λ spacing at 14.2 GHz)
- Simulated from 1200-1400 MHz in steps of 4 MHz using smooth Angelica sky model

Sky Scan




Fourier Transform of Sky Scan



# First Stage foreground removal – Sky Subtraction

- Take cylinder visibility data and subtract a simulation of a smooth sky into a cylinder model
  - How good is the sky model?
    - For this case we will assume the sky model is perfect
  - How good is the telescope model?
    - For this case we will try the case the telescope gain is off randomly feed-to feed by 10% and subtract off a uniform gain model of the telescope

# Cylinder Definition

pittsCyl01.xml | pittsCyl01BC0p1.xml

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Perfect Cylinders

pittsCyl01.xml | pittsCyl01BC0p1.xml

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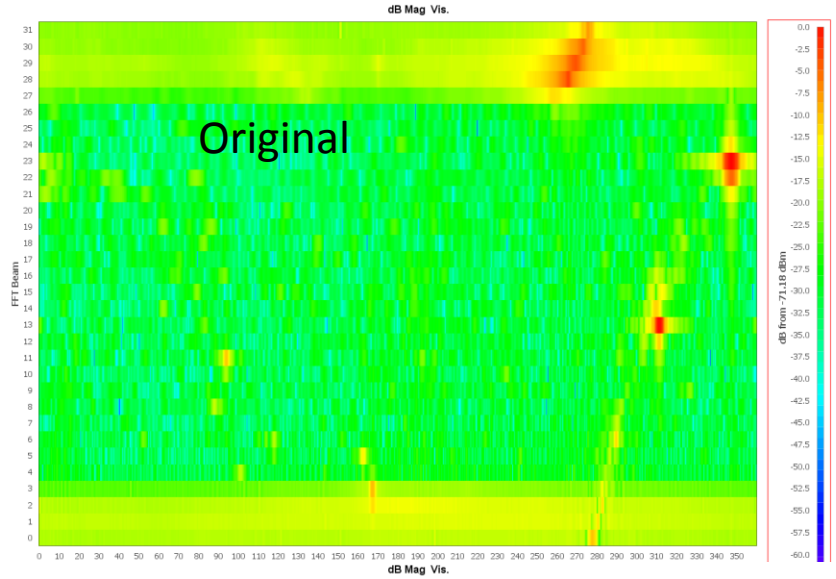
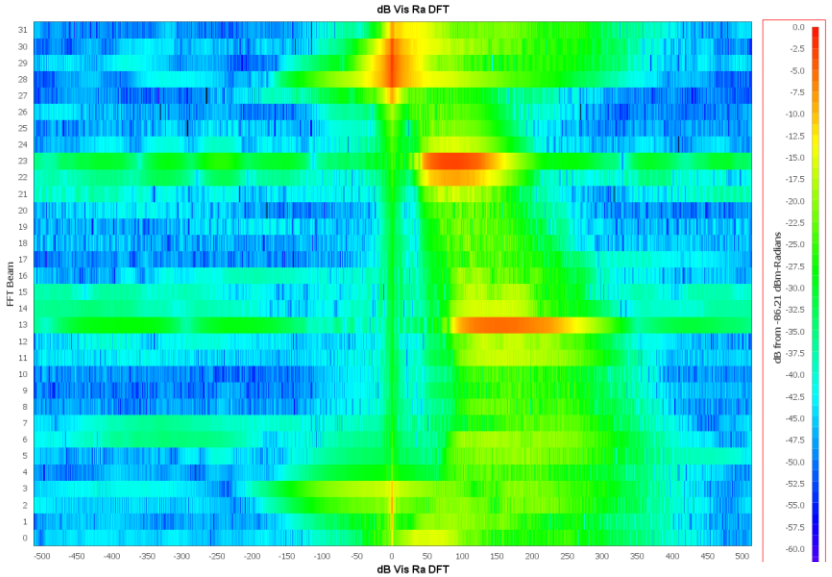
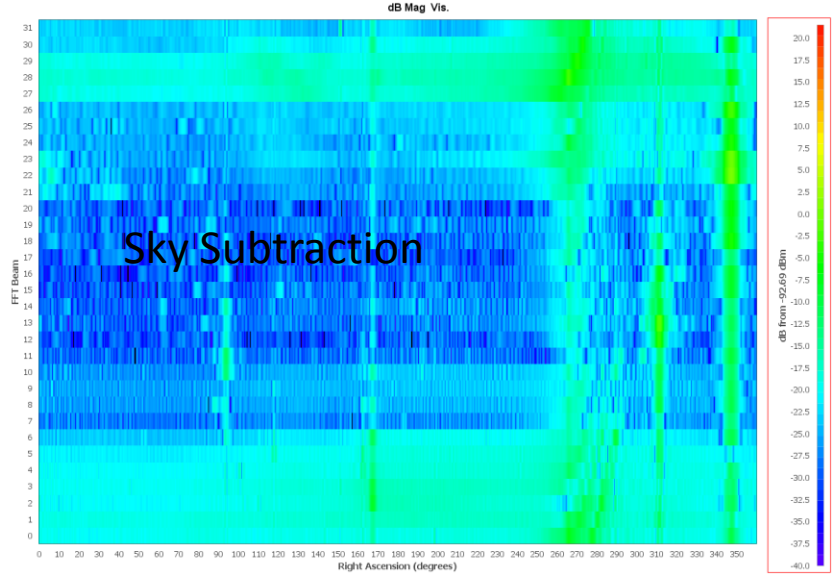
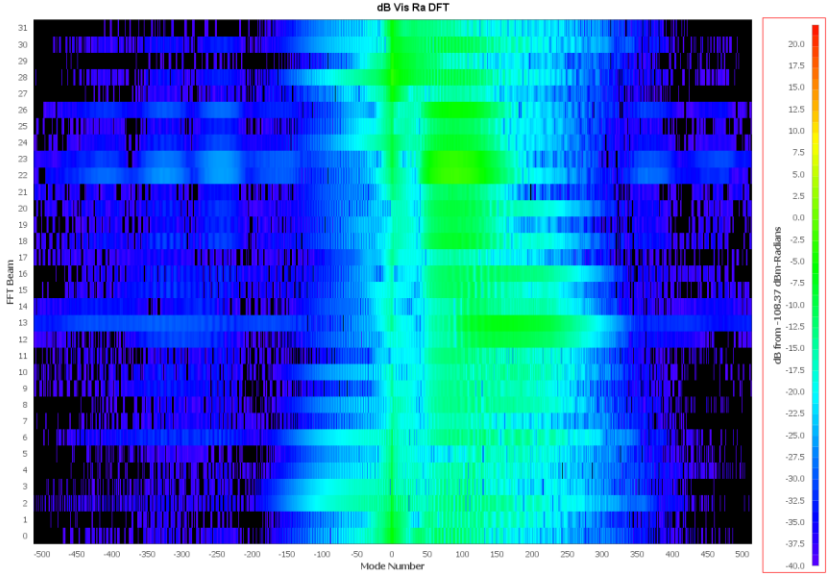
10% random gain error Cylinders

# Sky Subtraction Results



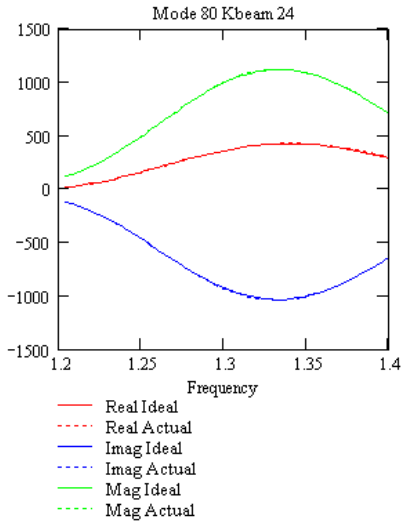



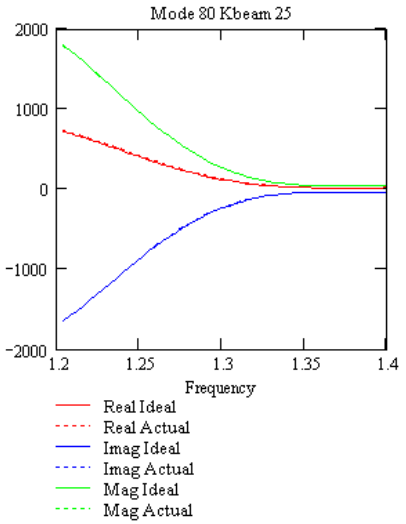



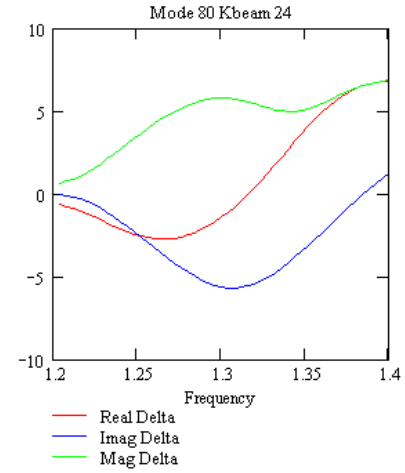
# Second Stage Smoothness Subtraction

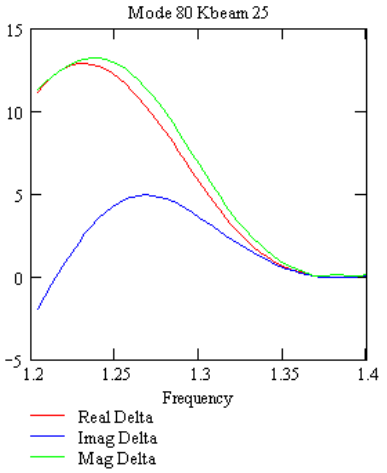
- From the sky difference map, fit each visibility spectrum “pixel” as a nth order polynomial in frequency
- A nth order polynomial will have n turning points.
- Further FFT filter the n tuning points

# Hottest Pixel track

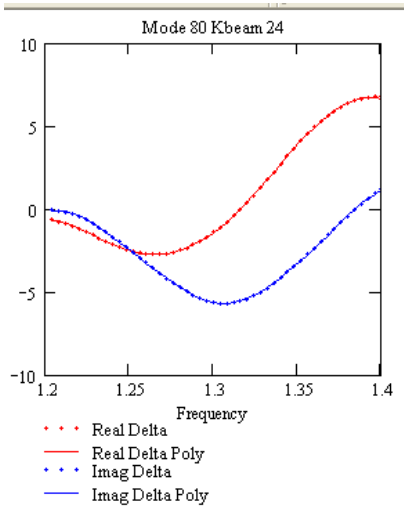


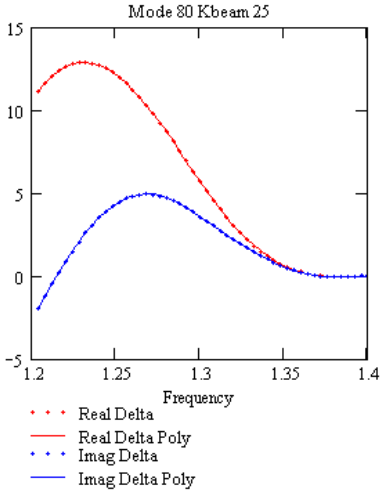



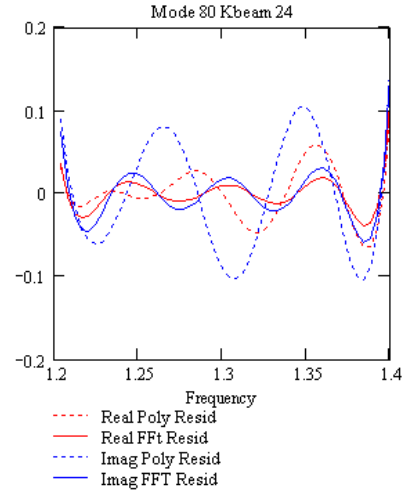



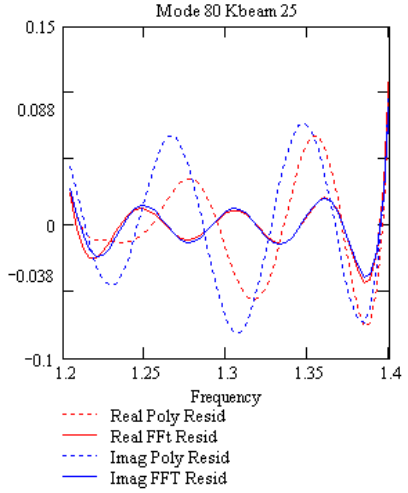



# Hottest Pixel Track Fit Residuals

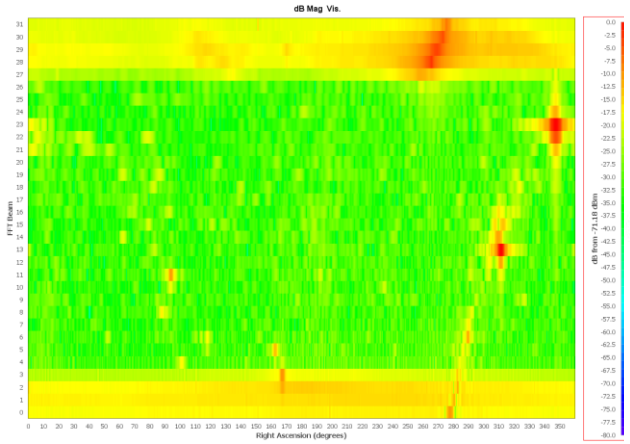


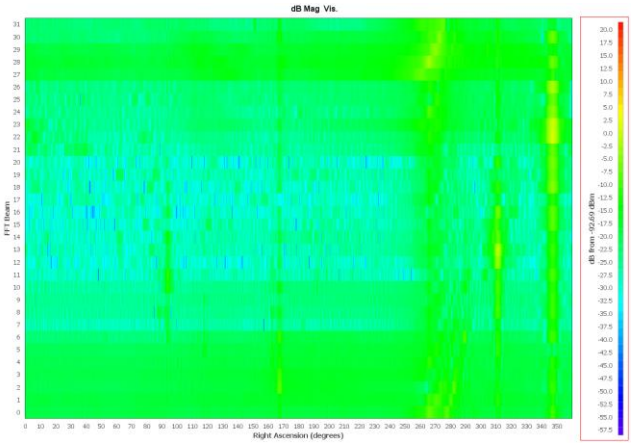



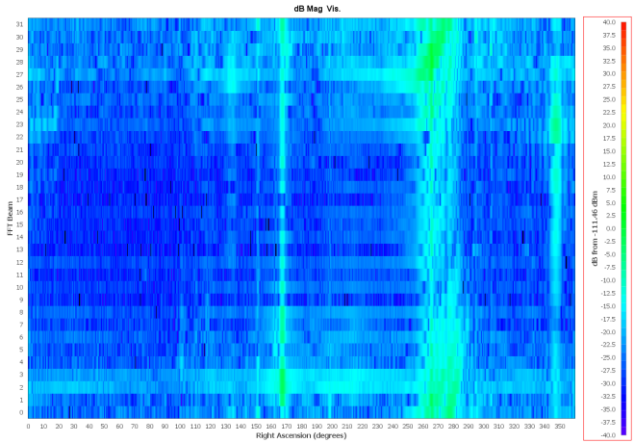



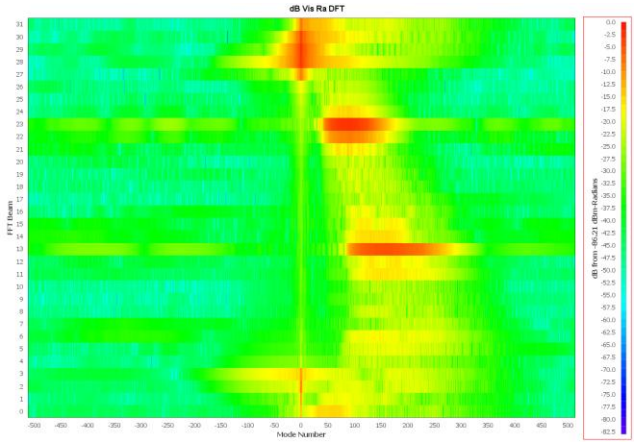



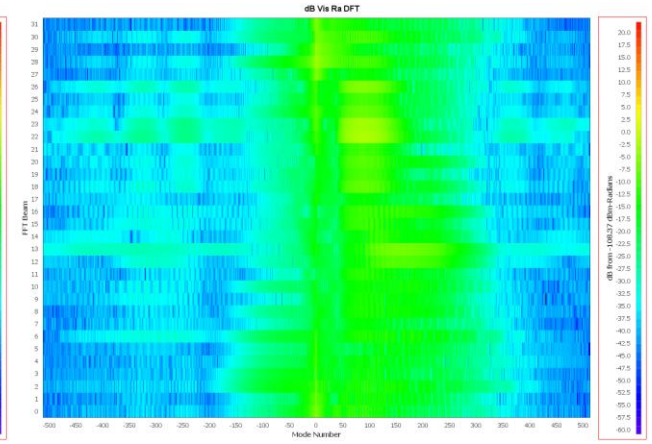
# Foreground Removal at 1300MHz

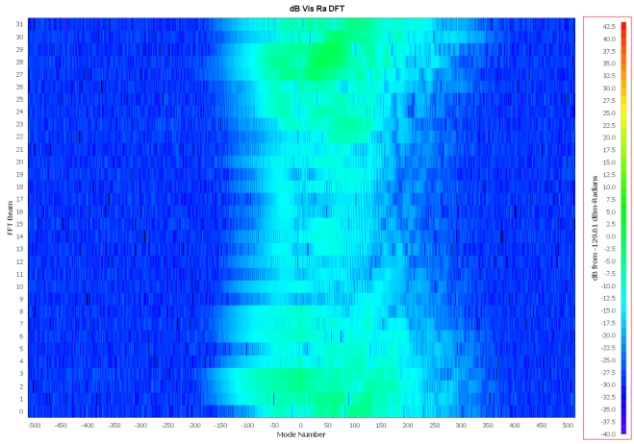



Original

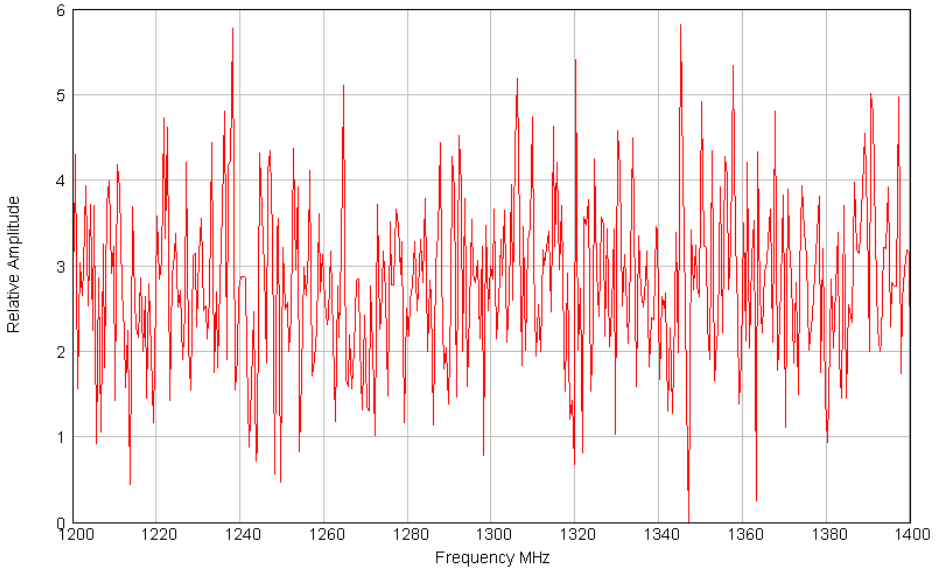
Sky Subtraction

Removing Smooth Frequency Component

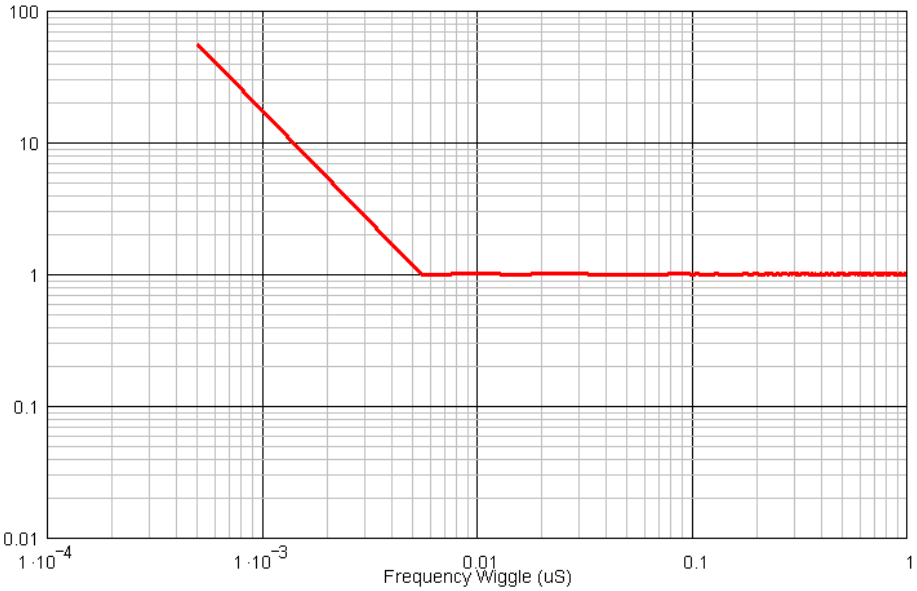
# Filter Corner Effects

- Put white noise along the frequency axis for a single pixel
- Measure how much the foreground subtraction cuts into the signal

Random fluctuations in frequency spectrum

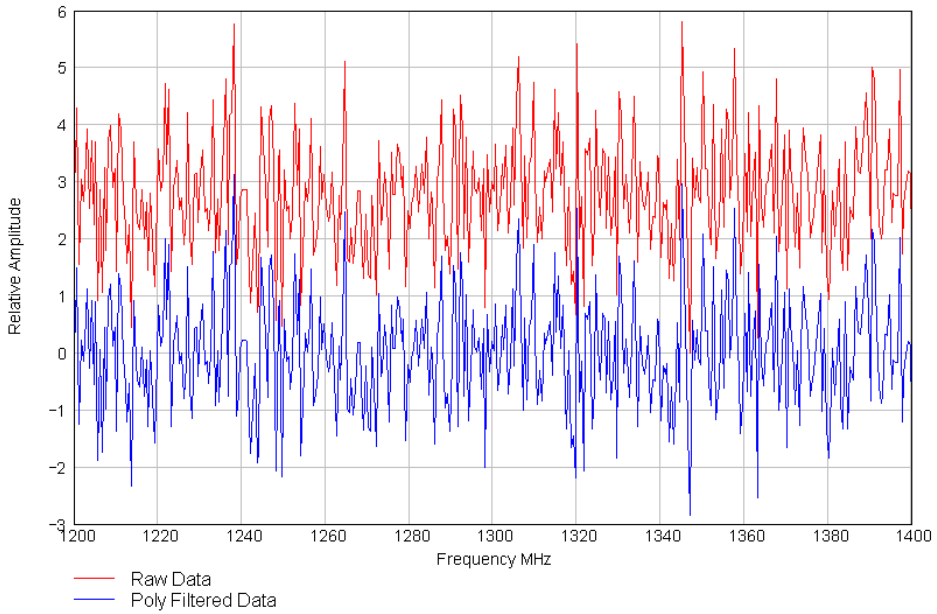



Fourier transform of random Fluctuations in frequency spectrum

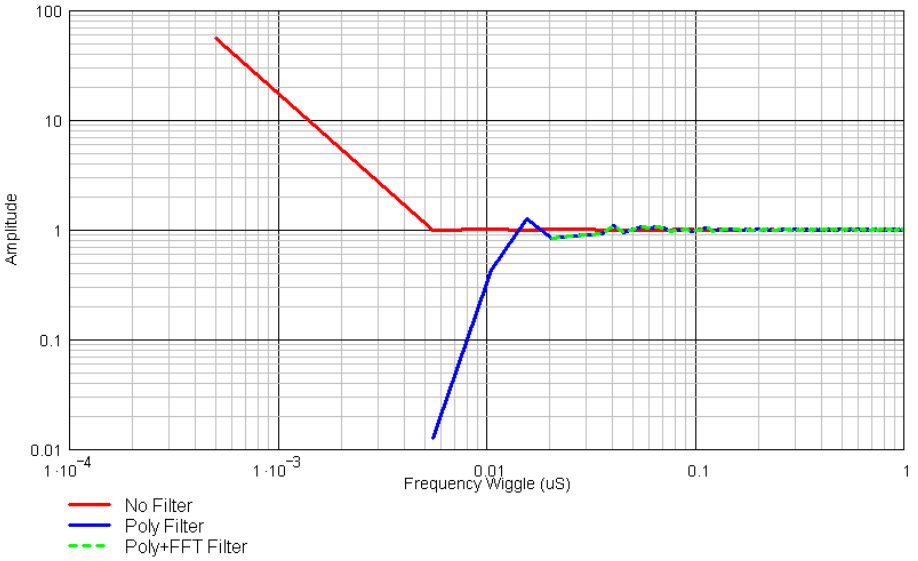


# Effect of 6 order Polynomial over 200 MHz

Random fluctuations in frequency spectrum with and without the filter




Fourier transform of random Fluctuations in frequency spectrum



# Future Work

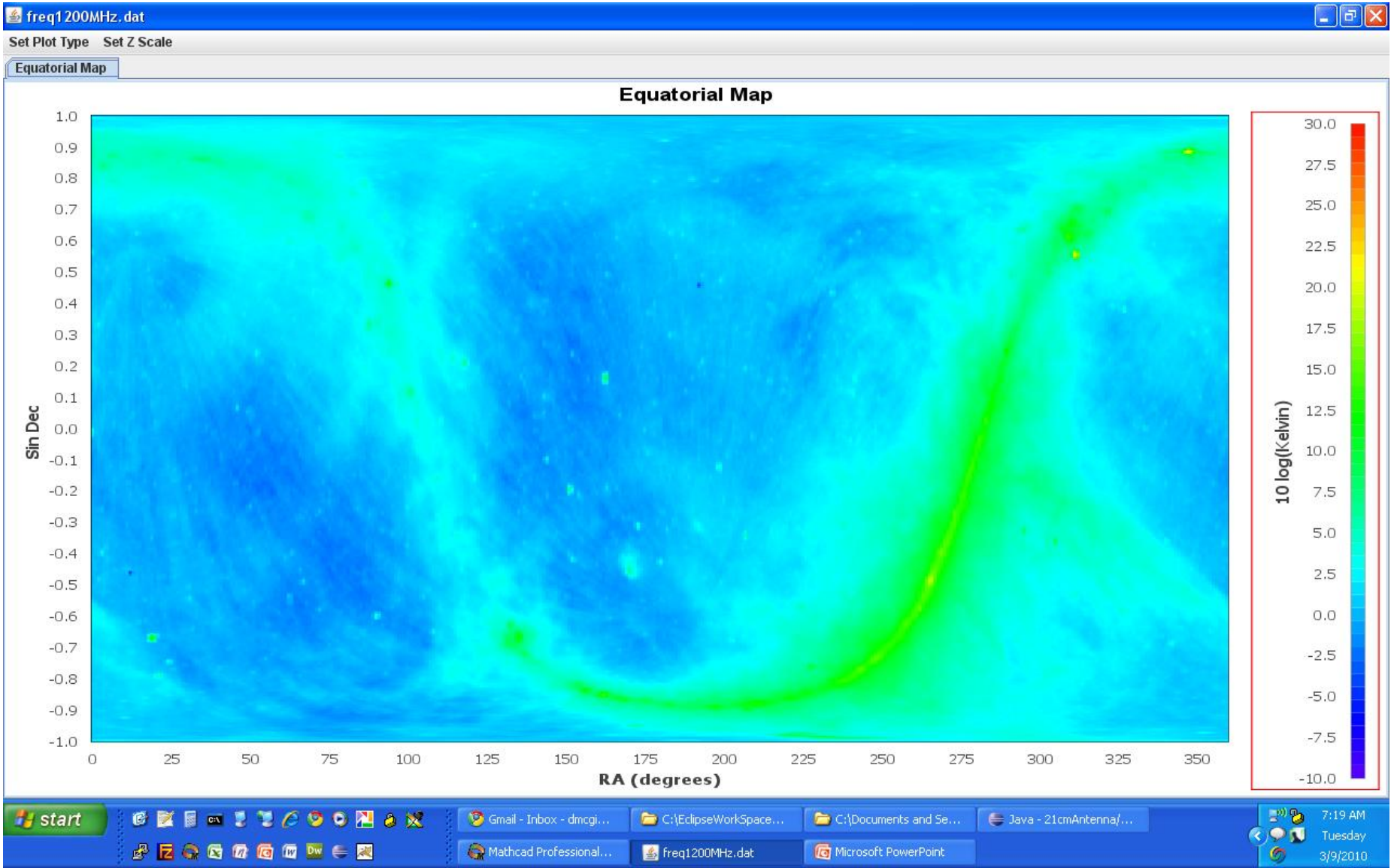
- Simulate simple source with uniform fluctuations along frequency axis to make a “gee-whiz” picture
- Incorporate 3-D BAO signal on top of smooth Angelica sky map
- Start to investigate “bubble” filters

# New Stuff - Frequency Fluctuating Sky Patch Simulation

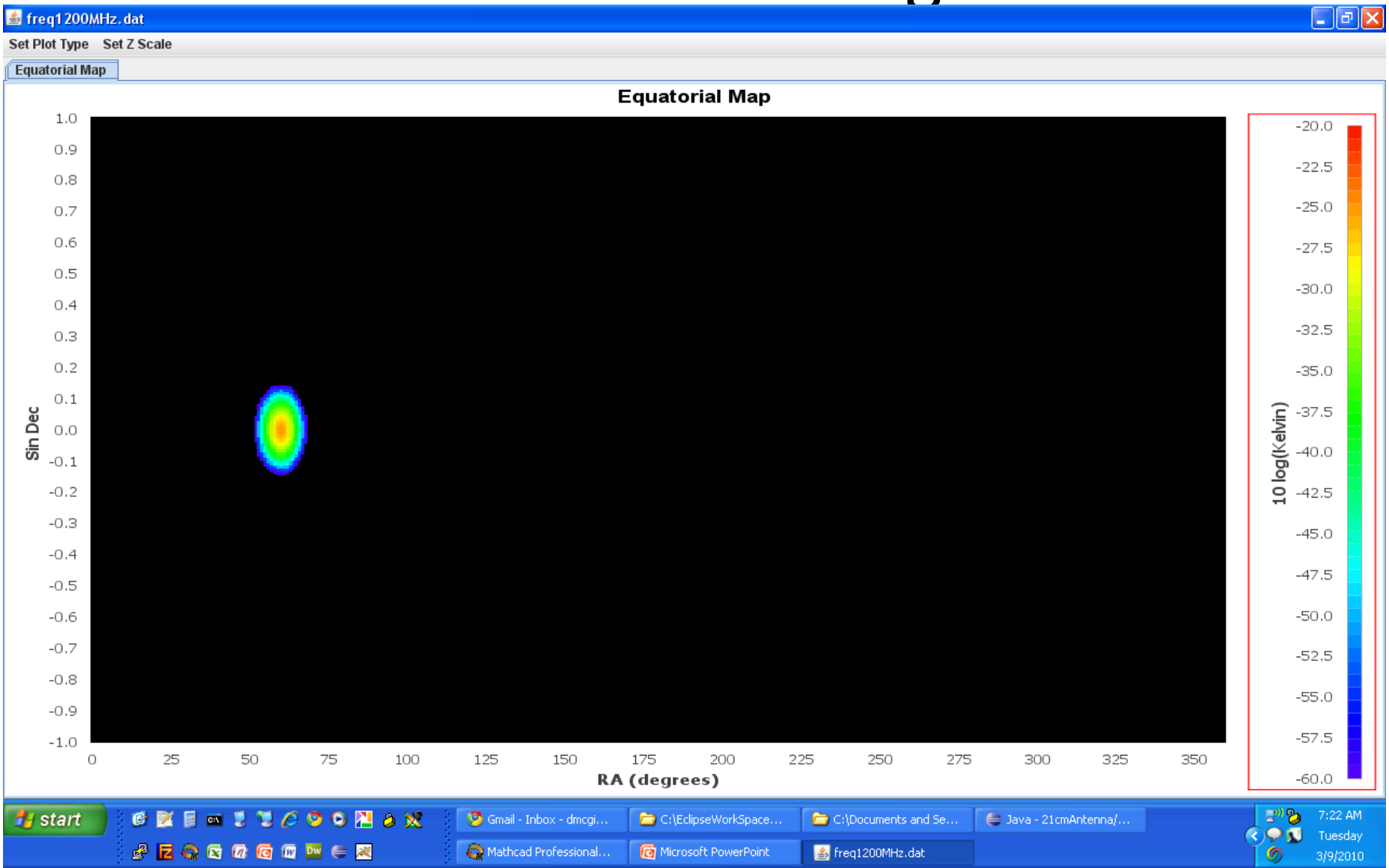
Dave McGinnis

March 9, 2010

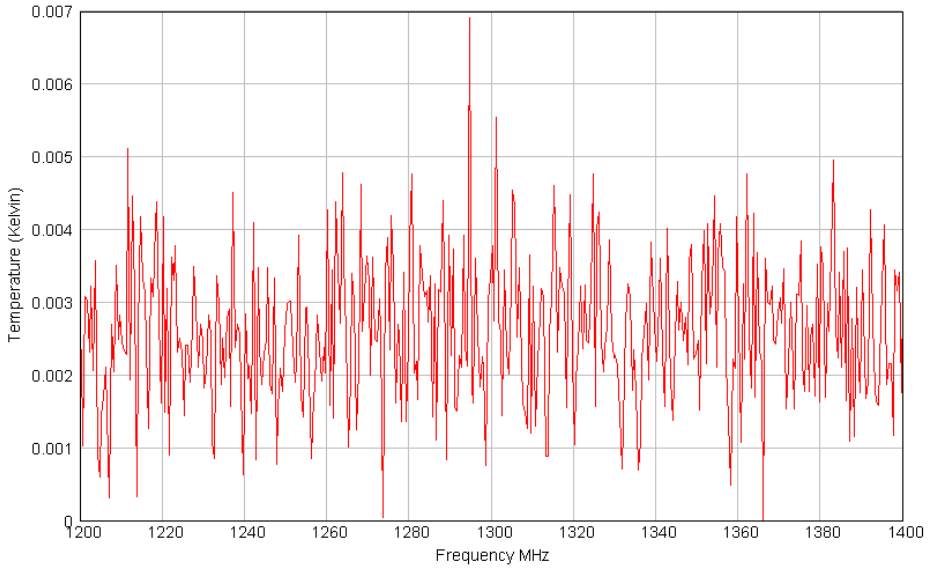
# Angelica Sky Map

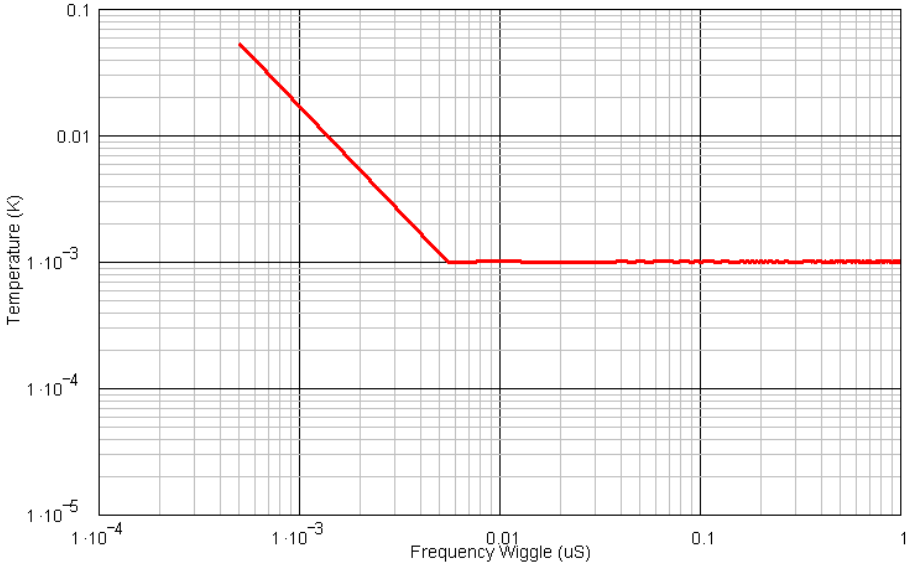


# Freq. Fluctuation Patch
# r.m.s radius = 3 degrees

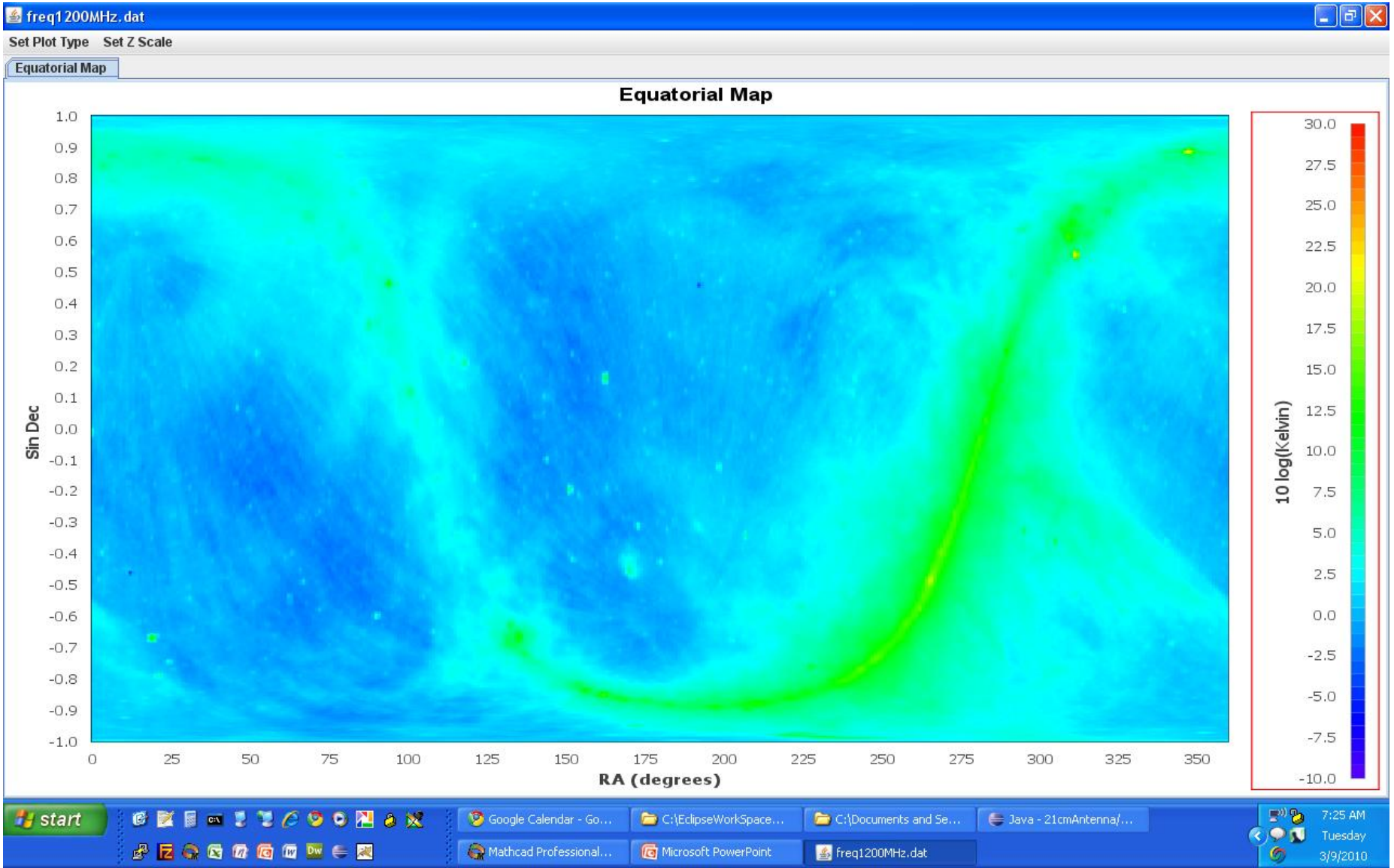


# Freq. Fluctuation Patch Temperature vs Frequency



# Angelica + Freq. Fluctuation Patch

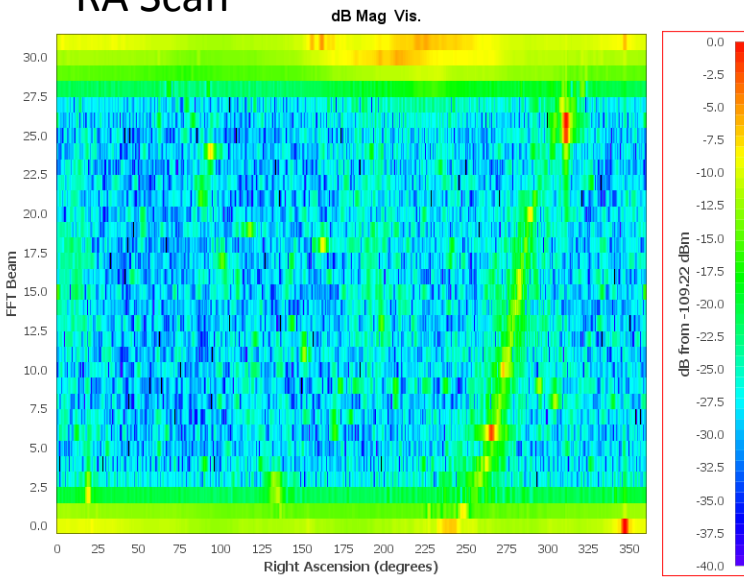


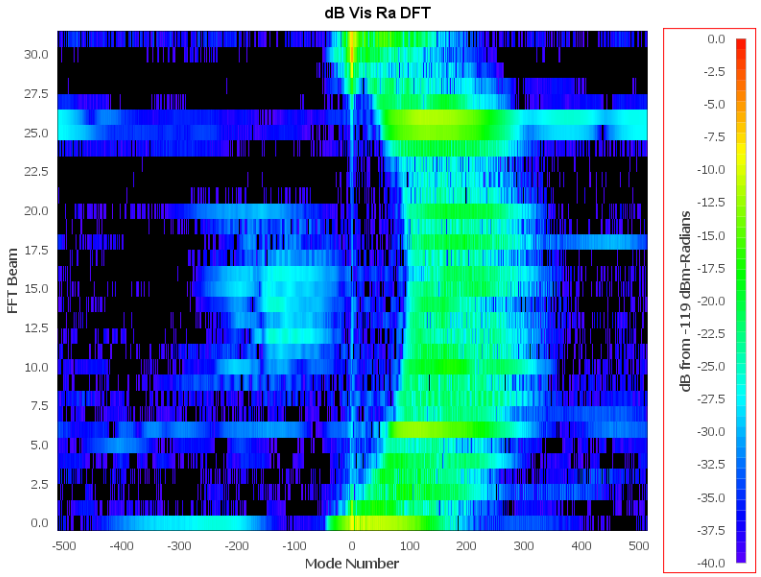
# Pittsburgh Cylinder Simulations

RA Scan

RA Scan DFT

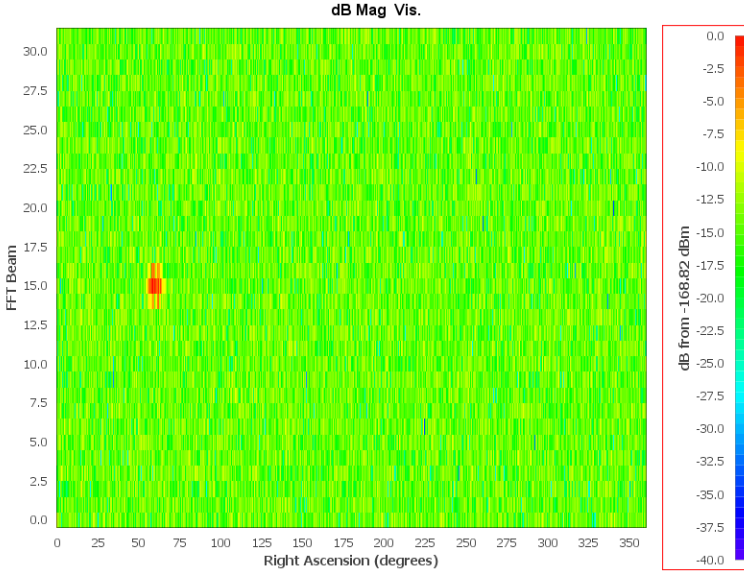
Clean Sky

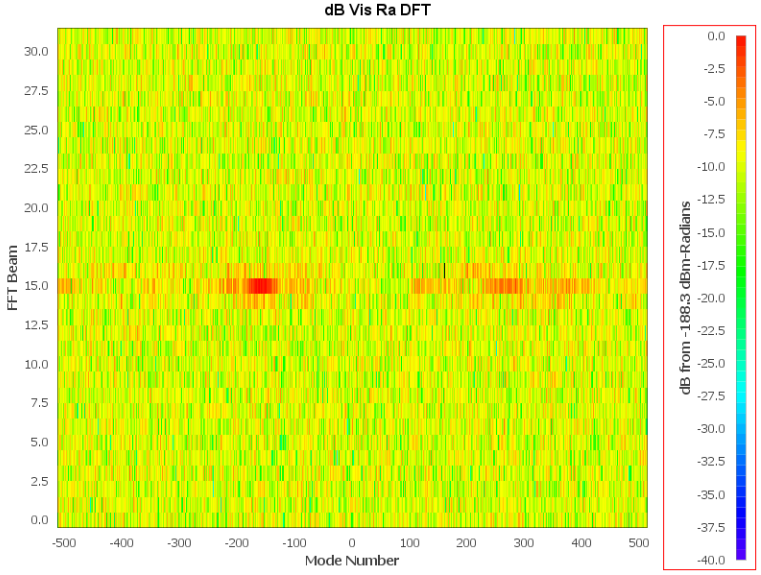



1e9 integration days

Freq. Fluctuation Patch Only



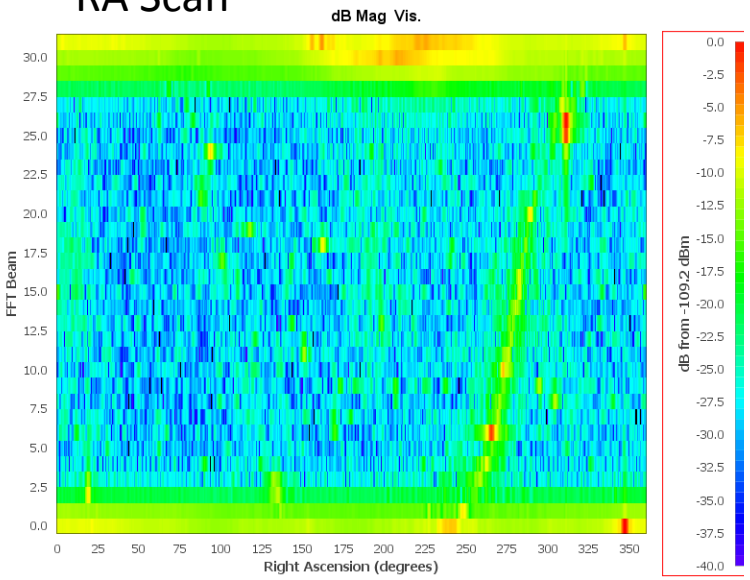



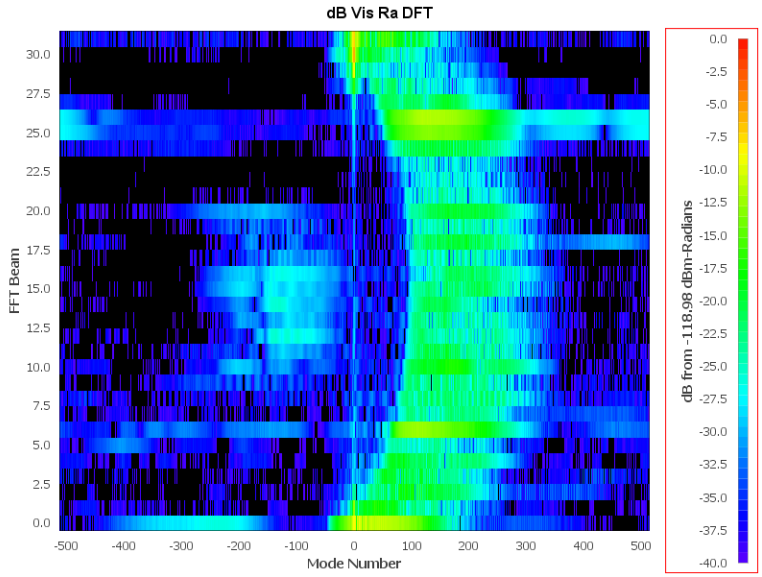
# Scan Differences at 1223 MHz

RA Scan

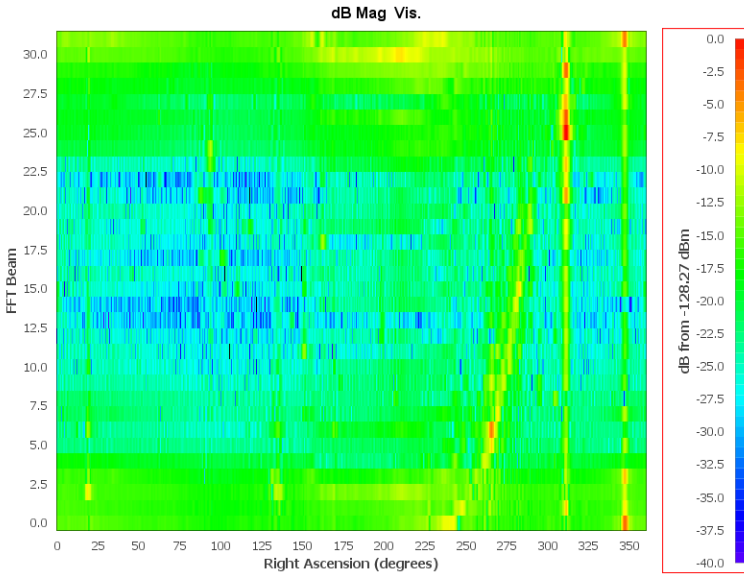
RA Scan DFT

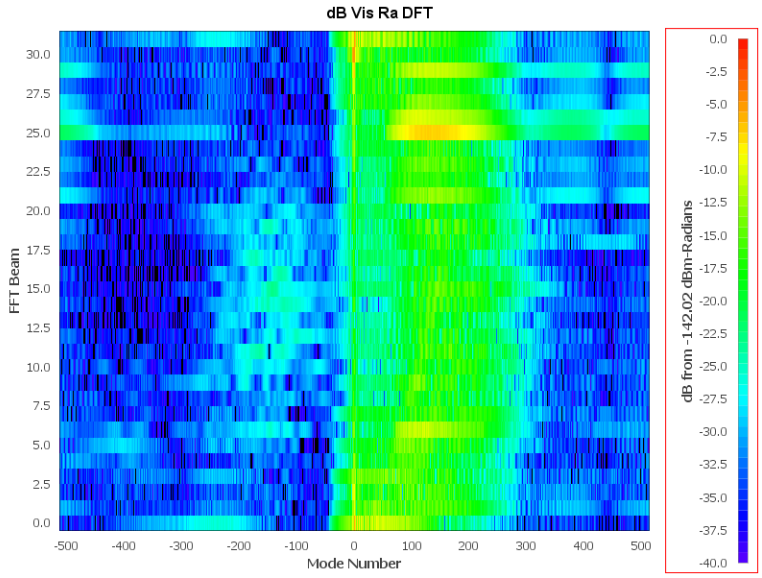
Clean Sky + Freq. Fluctuation Patch




Imperfect scan – perfect scan



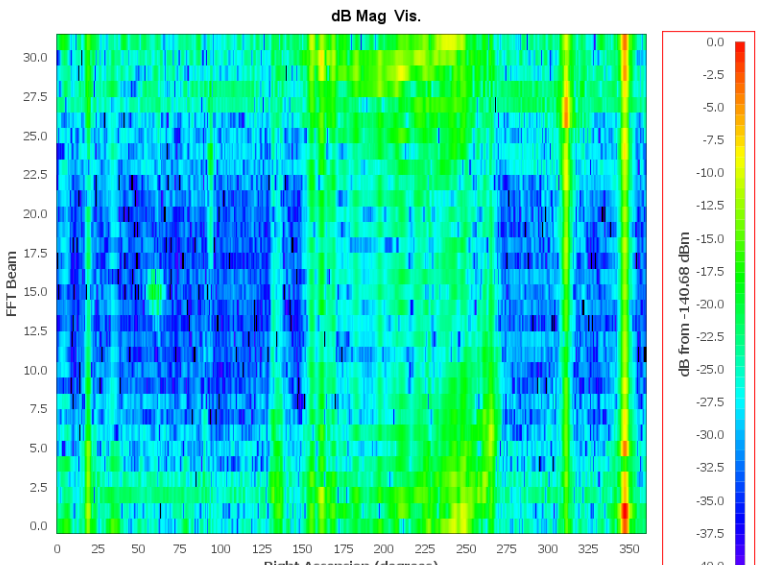
# Scan Smoothing at 1223 MHz

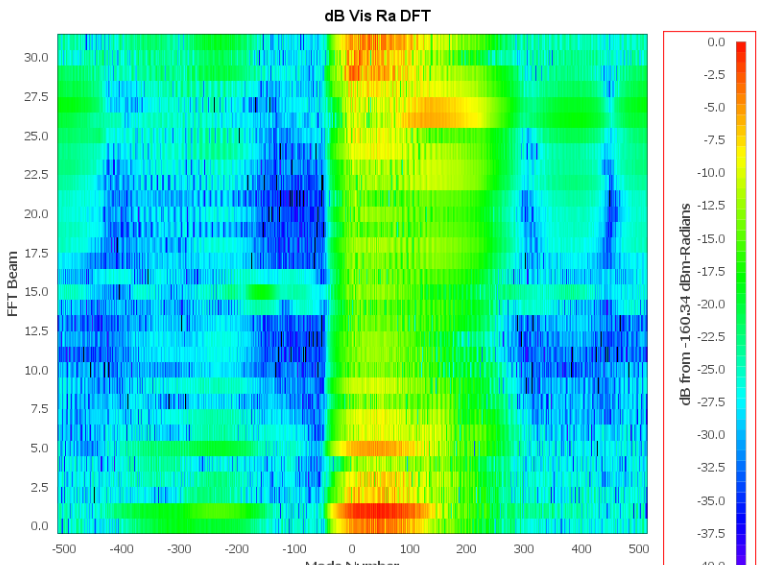
RA Scan

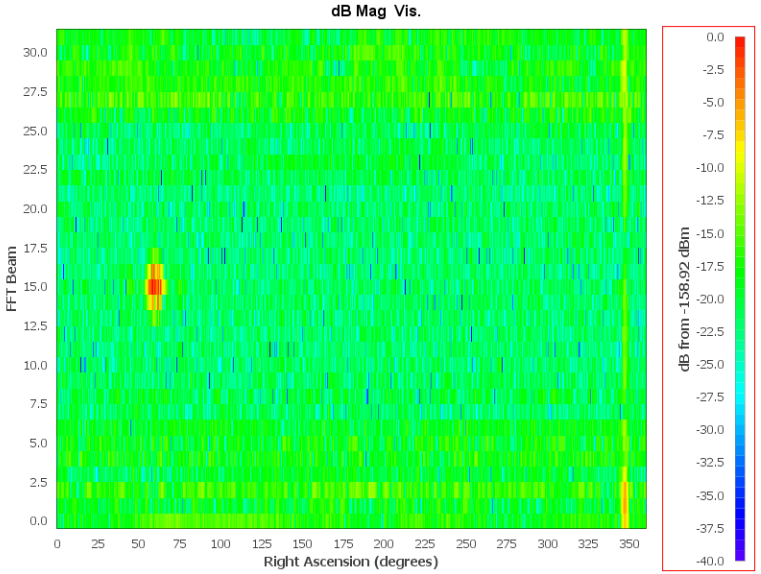
RA Scan DFT

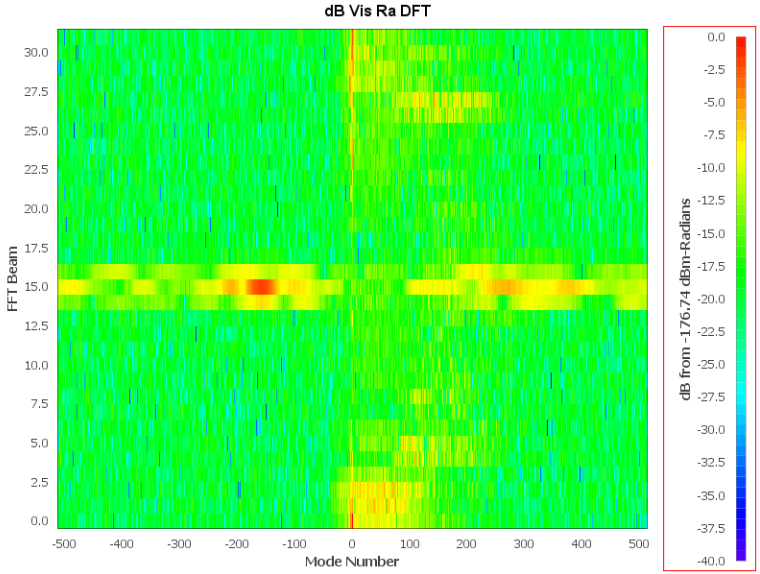
6 order smooth

12 order smooth

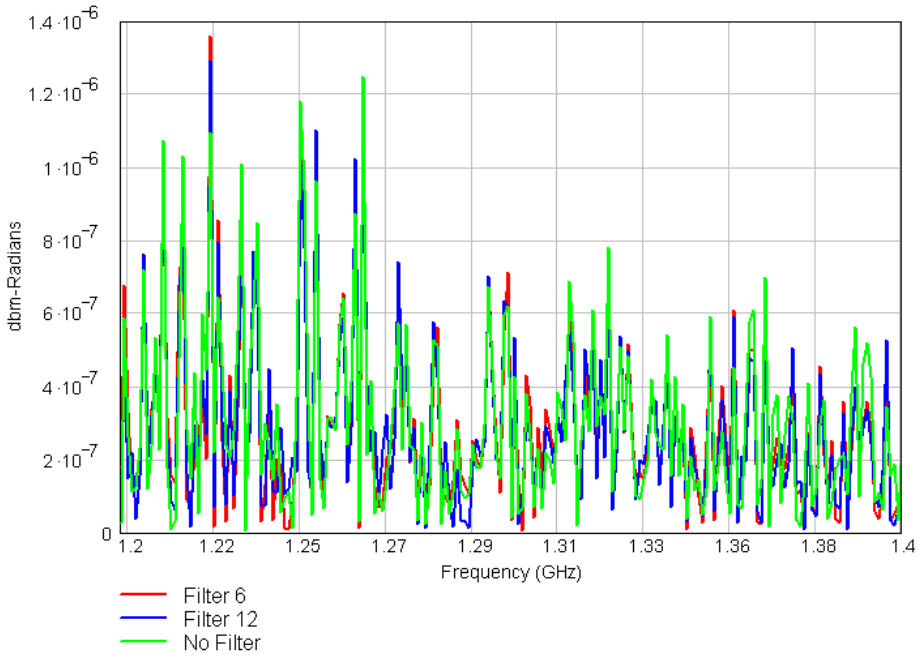


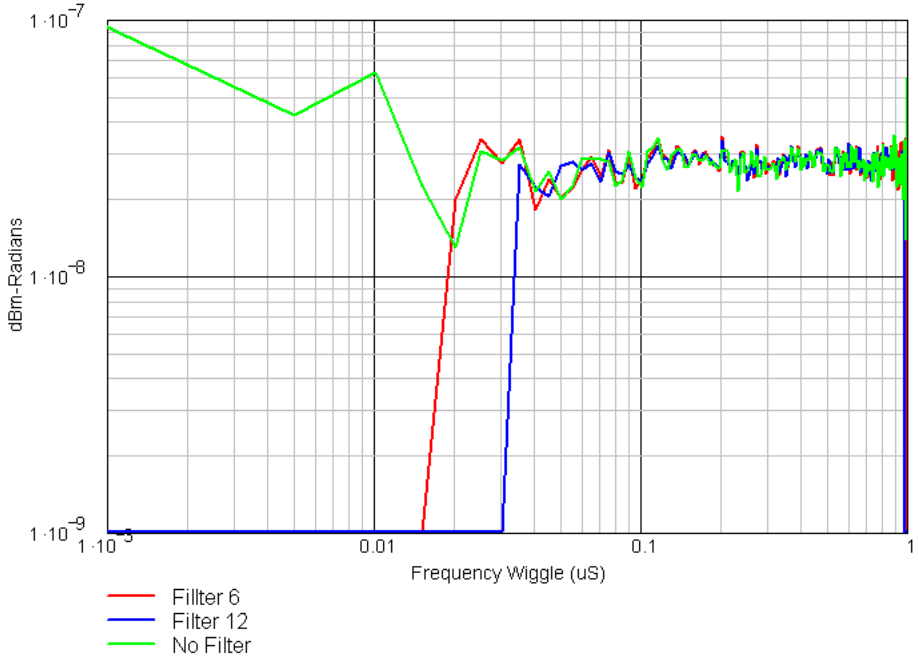



# Pixel Track – Mode 867 – Beam 15



# Future Work

- Incorporate 3-D BAO signal on top of smooth Angelica sky map
- Start to investigate “bubble” filters